THE GLOBAL eLEARNING JOURNAL
VOLUME 3, ISSUE 1, 2014

Virtual and Physical Connections: An Assessment of an Online Program

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Abstract

This study builds on the idea of embedded learning community and examines the technology and communication tools, class activities, and assignments used to achieve community building in the student's physical community and in their virtual community in an online library and information science master's program. It employs both quantitative and qualitative research methods. The quantitative analysis reports on a survey of library and information science (LIS) faculty on nine categories of involvement and included 33 master level courses that were taught between fall 2010 and summer 2012. Analysis of the quantitative data indicates which courses have the potential for creating high levels of virtual and physical connectivity and which courses have lower potential for virtual and physical connectivity based on class requirements and activities. The qualitative analysis includes analysis of student feedback in one course and one class activity. Analysis indicates that online and physical community building activities vary by type of course—archival, school library, core, and elective. This awareness can help to stimulate and increase levels of community-building activities in both required and elective courses in online programs.

Introduction

Distance education does not necessarily mean distant or disconnected education. Information and communication technologies (ICT), along with interactive activities and assignments, can connect students to faculty and to one another in their virtual learning environment; some assignments and activities can connect students with their local community.

ICT is a broad term used to describe communication applications or devices, like computer software, and the services accomplished through them, like distance learning (http://searchcio-midmarket.techtarget.com/definition/ICT). ICT is especially appropriate for community building as a platform for delivering course content and fostering interaction among students (Kazmer, 2005).

Of the fifty-eight library and information science programs currently accredited by the American Library Association (ALA) in the United States and Canada, twenty are offered completely online. This study is an assessment of an online master of library and information science (MLIS) program and evaluates the use of technology tools, class activities and assignments to achieve the community building in the students' physical communities and their online courses by surveying faculty about course requirements and activities.

Literature Review

Distance education contributed to the growth of e-learning or electronic learning which generally refers to computer-enhanced learning, from online tutorials to learning platforms like Blackboard (Kumar, 2008). "Online collaboration involves interaction between learners and faculty members through the web; this interaction can occur in one of the following modes: synchronous interaction or asynchronous interaction" (Kumar, 2008, p. 557). Distance education, or open learning, can involve a variety of tools such as email, discussion boards, videoconferencing, and chat. Successful integration of ICT and education requires the following: students and faculty have access to appropriate infrastructure (i.e., high-speed internet service); access to software (i.e., Blackboard); necessary computing and technology skills for the students and faculty; curriculum integration of appropriate and meaningful ICT tools – integrating in a meaningful way that supports goals and content instead of just including technology skills for the sake of including them; and management of ICT innovation on various levels – school, university, state, etc. (Kumar, 2008).

Other than the necessary tools, skills and infrastructure, students need appropriate interaction with instructors, and instructors need to understand and leverage tools like Blackboard appropriately to create online engagement and sense of community (Hemp, Woollen, & Humiston, 2009; Wang, 2011). In addition to access, use and understanding of ICT tools and their role in education, it is also important to look at and is useful to define and describe relevant learning theories upon which this research builds.

Connectivism and Active Learning

Siemens (2004) defines learning as "actionable knowledge" that can reside not only in humans but within an organization or database that *connects* information. Principles of connectivism include:

> Learning and knowledge rests in diversity of opinions.
> Learning is a process of connecting specialized nodes or information sources.
> Learning may reside in non-human appliances.
> Capacity to know more is more critical than what is currently known.

> Nurturing and maintaining connections is needed to facilitate continual learning. Ability to see connections between fields, ideas, and concepts is a core skill. Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities. Decision-making is in itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the
> lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. (Siemens, 2004, para. 22)

Since the core skill in connectivism is the ability to see or make connections between ideas or concepts and may reside in non-human appliances, this learning theory has been associated with online learning using emergent technologies.

According to Farrell, "engagement is inseparable from empowerment" (2009, para. 12). Active learning is the opposite of the traditional learning model of students in a classroom passively listening to a lecture. It is the process of active engagement and hands-on experiences involving discussion, problem-solving, analysis, synthesis, and evaluation. Examples of active learning activities include: class discussion or demonstration, storytelling, game playing, role-playing, group projects, field trip or study abroad, creation of Web content, participation in social media, and practicum or internship.

In today's multimedia distance education environment, the activities associated with active learning may be accomplished through virtual synchronous discussion, communication, or collaboration; asynchronous postings with feedback; and activities conducted at the students' locale, such as locally-mentored internships. An important part of this process is the *feedback* from instructors and peers, which can enhance students' motivation and skills (Duijnhouwer, Prins and Stokking, 2012; Straub, 1997; Kluger and DeNisi, 1996).

Community and Community Embedded Learning

Hunter's definition of virtual community is "a group of people who interact with each other, learn from each other's work, and provide knowledge and information resources to the group related to certain agreed-upon topics of shared interest" (2002, p. 96). It is dependent upon all participants---students, educators, and the home community---being contributors to the knowledge base. However, not all virtual learning communities are created equal and several learning factors play a role in in these communities. Nolan and Wiess address the following: the learner's "role within the community, his participating style (e.g., active participant or lurker), the structure of pedagogy associated with the space, resources for structuring the community, and, of course, what is to be learned" (2002, p. 294). There is additional impact on the learner and community from the way that the community is designed, the process the learner goes through when joining the community and the skills needed to be a part of the community. Even in online learning environments, collaborative learning is a pedagogical practice that is accepted as a good learning practice but is dependent on the three interdependent legs of Russian activity theory: tools, activities, and people (Hoadley & Pea, 2002).

The technology tool used should affect the activity and the activity should affect the student and the way they contribute to the knowledge base and interact as a community. Using ICT, like email, learning platforms, and chat rooms, students and faculty can create and sustain community no matter where the participants are located (Haythornthwaite, Kazmer, Robins & Shoemaker, 2000). The use of technology tools, like threaded discussions, aid in deepening class ideas through discussion, sharing between students, and drawing-out feedback (Wang, 2011; Hewitt, 2003).

In the interactive learning model of distance education, students develop an online community via technology, creating connections that lead to relationships and networks. It has four recognizable

features: (1) it uses a variety of technology for "private, group, and public communication;" (2) the activities are "synchronous and asynchronous;" (3) interaction takes place regularly between the students as well as with the professor; (4) "courses are not self-paced" (Kazmer 2005, p. 194). Students in online library and information science programs are
connected to two communities – their physical community (family, friends, clubs, social groups, etc.) and their online education community (Haythornthwaite, 2000 et. al; Kazmer, 2005).

Community-embedded learning implies a relationship of give and take where students bring knowledge from their courses to their community and vice versa (Kazmer, 2005; Most, 2011). These connections, or transfers, are "summarized as (a) community knowledge to social world, (b) course knowledge to workplace, (c) social world contacts to home community, (d) course knowledge to home community, and (e) institutional connections" (Kazmer 2005, p. 196). Even though some studies have reported that students do not like synchronous learning, like live chat, (Wang, 2011; Chang, 2009), synchronous activities are integral in the interactive learning model of distance education for developing online community via technology (Kazmer, 2005). Additionally, activities in the physical library or information environment provide students with the opportunity to apply what they have learned in coursework, develop professional relationships, develop a professional attitude, and get practical experience (Small, Arnone, Stripling, Hill, & Bennet, 2012).

Methodology

This study builds on the idea of embedded learning community, connectivism, and active learning and examines the technology and communication tools, class activities, and assignments used to achieve the community building in the student's physical community and their online courses in an online MLIS program. It employs both quantitative and qualitative analysis.

Research Questions

R1. Which courses in this study required virtual connection with the students' online learning community?
R2. Which courses in this study required physical connection with the students' local community?
R3. Which courses required more virtual community-building assignments and which required more physical community-building assignments?
R4: Did the amount of virtual and physical community building differ among course type: core, school library, archival and elective?

Quantitative Methodology

While there are many course activities that students are required to do while in the program, nine categories of involvement were created based on student activity and interaction within the online community and physical community. The categories were: (A) conducting activities in local/physical community; (C) synchronous chats; (D) discussions with required response; (G) group projects or presentations and group work; (I) internships and practicums; (P) creating podcasts or vodcasts with peer feedback; (S) using social networking: Facebook, LinkedIn with required connections with others; (V) conducting interviews or conversation/interaction with information professionals; and (W) using Web 2.0: blog, glog, wiki, Web page, image sharing, etc. with peer feedback. Some examples of activities in the physical community included storytimes at a local facility, weeding a portion of a

physical collection, and lesson plans created in conjunction with school librarians. All of the nine categories required student to student interaction, student to faculty interaction, or student to practitioner or professional interaction.

As with any program, there are courses that are taught on a regular cycle and others that are taught less frequently due to the nature of the course or due to the failure of the course to meet the minimum enrollment. This study looked at 33 master level courses (or 66% of the courses in the Graduate Bulletin) that were taught from fall 2010 through summer 2012. Each faculty member was provided with examples of the activities in each category then surveyed about what activities from the nine categories were included in their classes. The data were recorded on a checklist of the categories (Appendix A).

Results

Quantitative Results

For the first research question—Which courses in this study required virtual connection with the students' online learning community?—it was found that 31 of 33 courses (94%) include activities that foster online community. The most common elements for inclusion are synchronous chats (91%); discussions with required response (45%); collaborative/group projects, presentations or work (27%). Only three courses did not require synchronous chat— a study-abroad course, which is face-to-face, and the two practicum courses.

In regards to research question two— Which courses in this study required physical connection with the students' local community?—33 percent of courses required activities that foster interaction in the physical community: 24 percent required an activity, 15 percent required an internship or practicum, and 6 percent required an interview or interaction with an information professional.

When it comes to the third research question—Which courses required more virtual community-building assignments and which required more physical community-building assignments?— the MLIS program was far more successful implementing online community building versus physical community building. Ninety-four percent of the courses contained activities that fostered online community verses 33 percent of the courses that fostered physical connections in their community. Appendix A depicts the online verses physical activities by category.

In order to answer research question four—Did the amount of community building differ among course type: core, school library, archival and elective?—and to add more statistical detail to question three, t-test were conducted using a community-building variable and course type. The complete results of the various t-tests can be found in Appendix B. In two cases, there was statistical significance in the results. Archival courses, on average, had fewer community building activities ($Pr(|T|> |t|) = 0.0576$) and school library courses, on average, had more community building ($Pr(|T| > |t|) = 0.0062$). Additional t-tests were done examining whether or not there was a difference in the mean number of community building activities across course type and across activity type (online versus physical). Results indicated statistical significance in five cases. Elective courses, on average, had fewer physical community-building activities ($Pr(|T|>|t|)= 0.0000$). Archival courses, on average, had fewer online community-building activities ($Pr(|T| > |t|) = 0.05$) but had more physical community-building activities ($Pr(|T| > |t|) = 0.0000$). School libraries were more likely to include more online ($Pr(|T| > |t|) = 0.0218$) and more physical ($Pr(|T| > |t|) = 0.0154$) community-building activities.

Qualitative Results

In addition to investigating courses from the perspective of the faculty, the reference course was used to provided additional information on how small group reference interview practice improved connection to the online community and potential impact in the physical community. Reference is a required core course and is often one of the first courses taken; it also ranks first along with another course for the most community building activities. Students meet in small groups three times. After each meeting, they assess their role and their group members on the experience. There were 57 evaluations total from the three group meetings.

Supporting Qualitative Evidence

Overall, very few evaluations were negative—three out of 57 (approximately 5%). Just over 40 percent of the evaluations reported both positive and negative comments about the group experience. Fifty-four percent of the evaluations were strictly positive. The comments are classified into the following categories: provided people connections, created course content tie- ins and fostered the application of newly acquired knowledge, provided personal affirmation and self-esteem building, created positive course feelings and a safe environment, and application to real life settings.

Provided People Connections:

- "I enjoyed the interaction with people because I am a people person. I think that it could be easy for students to feel a bit like an island at times so *it is nice to meet new people*..."

- "My group was incredibly supportive… One group member *sent me a personal message* about a source to use for the question I was trying to answer."

- "It is difficult to act out scenarios with people I'm just *getting to know*."

This master's program is completely online. Students do not meet for a face-to-face orientation and may not even meet at graduation since only approximately half of the students are in-state. Providing people connections can help to combat feelings of isolation.

***Created Course Content Tie-ins and Application of Newly-Acquired Knowledge**:*

- "I *learned from the question and answer exchanges* from each exercise. We had some really good role-playing in our group.

- "*Reinforced what I learned* with the Treasure Hunts."

- "Through reading the textbook and listening to your lecture, I learned some new ideas… we *had a discussion* about using Google as a head start."

- "One question took all of us to find the answer for the customer. It took all of our combined resources and knowledge. *We learned about new databases from each other* and how to approach a topic differently."

This feedback echoes Wang's assertion (2011) "that appropriate use of the communication tools helped students interact and collaborate with peers closely in online courses, which in turn, provided

them the opportunity to learn from other resources than just the textbook and the instructor" (p. 87).

Provided Personal Affirmation and Self-esteem Building:

- "… a lot of *advice and encouragement* was offered to all parties, which was good to see, particularly when the *group assured me my rapport-building was not as bad as I fear*."

- "I also think that my group's *feedback let me know that I have great people skills* and make them feel like I want to help."

- "This class will *improve my competency as well as my confidence*."

In some class environments, the only feedback that students get may be in the form of grades and comments on assignments. Peer assessment can enhance student learning (Liu & Carless, 2006).

Created Positive Course Feelings & Safe Environment:

- "I *learned a great deal* from listening to others role-play and gained significant practice."

- "The experience of practicing *was invaluable*."

- "I man a reference desk every day that I am at work, yet the role playing was very helpful. *It's a great, harmless way to make mistakes and learn from them*."

Repeatedly students reported being encouraged, feeling supported, and that the group breakouts were a highlight of the class. These comments showed up on the course evaluations and ratings. The overall rating for the course was 47.6 percent highest rating and 52.4 percent high rating.

Application to Real Life Settings:

- My efforts in preparing questions for this exercise have *helped me further realize the importance of skillful use of the reference interview* to assist patrons, many of whom have little idea of the nature of our search process."

- "This practice has *helped me in my real life situations* to be better at asking good questions, listening, and slowing down a bit."

- "I work as an academic reference librarian and feel quite natural helping patrons… but I have learned that I need to *slow down and ask more questions*. My class interaction was not perfect and could use improvement, but this exercise has helped me be more aware of how I connect with patrons at work."

Group breakout helps to meet several American Library Association Core Competencies like, "1I. The techniques used to analyze complex problems and create appropriate solutions; 1J. Effective communication techniques (verbal and written); and 5A. The concepts, principles, and techniques of reference and user services that provide access to relevant and accurate recorded knowledge and information to individuals of all ages and groups" (ALA, 2009).

Of the 57 evaluations, over 94 percent of them contained positive comments. The selection of comments presented here were included not because they were extraordinary in nature, but

because of their ordinariness. These comments indicate small group practice improved connection to the online community and had potential impact in the physical community.

Conclusion and Implications

Analysis of quantitative data indicate that, overall, elective courses have fewer required physical activities in students' local communities; archival courses have fewer virtual community- building requirements but more physical community-building activities in their local communities; and school library courses have a high number of required community-building activities, both virtually in the online environment and physically in students' local communities.

Analysis of qualitative data in an entry-level reference course that had a high level of both virtual and physical community-building activities indicate that students in general have positive comments for both virtual and physical community-building activities in that they reinforce course content, provide collaboration with and feedback from peers, and allow students to practice real-life professional scenarios.

This study identifies activities related to virtual, online community-building and physical, local community-building. Analysis of the quantitative data indicate which courses require high levels of virtual and physical connectivity and which courses have a lower level of virtual and physical connectivity. This awareness can help to stimulate and increase levels of community-building activities in both required and elective courses in online programs. Additionally, it has led to discussions on how to bring some of the online activities into the physical realm and vice versa —for example, including online interviews or creating web pages for a library and then sharing them with their peers.

"Increasing virtual community-building activities can have the effects of creating opportunities for students to build strong social networks based around the college and, therefore, to become committed and involved alumni of a program" (Nicholson, 2005, p. 220). Also, community- building is another way to connect students to alumni and reinforce alumni connection with the program. Haythornthwiate, et al., (2000) discovered a need for "initial bonding" among students in their study, which indicates the importance of incorporating community-building activities into entry-level courses. Faculty who teach online may consider what can be done in an online program's initial courses to increase virtual connectivity among students and physical community-building between students and their local community. Kumar (2008) suggests that ICT can be used to enhance learning by using audio and video to lead to greater understanding; linking to additional websites, video tutorials, etc. increasing availability of instructional material; and enhancing research via software and presentation of new research. This study looked at these types of tools and assignments and their potential to create and enhance community.

Future Directions

This first look at an online MLIS program and its use of technology, course requirements, and assignments to technology has generated some additional areas to research. First, a survey of students has been developed to determine their level of connectedness to their online course community and physical community and what role did the technology tools and course activities identified have in creating community in the eyes of the students. This research is underway. Second, is there unsolicited qualitative evidence in the courses that students feel a sense of community (i.e., similar to spontaneous utterance, like in introduction discussion posts where students indicate pleasure at having another class

with a peer)? Another possible area of research is to determine the growth of the sense of community as students progress through the program and whether the sense of community extends beyond the program. Finally, in courses with low level of community building activities, what can be done by faculty to increase the sense of community?

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Appendix A: Virtual and Physical Connections by Course

A = Activity in local/physical community

C = Synchronous chats

D = Discussions with required response

G = Group projects or presentations

I = Internship/Practicum

P = Podcasts or vodcasts with peer feedback

S = Social networking: Facebook, LinkedIn with required connections with others

V = Interviews and Interaction with information professionals

W = Web 2.0: blog, glog, wiki, Web page, image sharing, etc. with peer feedback

Course	**Virtual Connections**	**Physical Connections**
Reference Sources and Services	C, D, G, P	A, V
Cataloging and Classification	C, D, G	
Advanced Cataloging	C, D, G	
School Libraries	C, D, G	A, I
Collection Development	C, D	A
Media Utilization	C, D	
Children's Literature	C, D, G	A
Young Adult Literature	C, D, G	
Storytelling	C, D, P	
Information Ethics	C, D	
Information for Multicultural Society	C, D, W	
Library Computer Applications	C, S, W	
Internet Resources and Applications	C, D, W	
Study Abroad	S, W	A

Library Management	C, G	
School Library and Curriculum	C, D, G, W	A, I
History of Libraries	C	A, I
Academic Libraries	C, D, P	V
Public Libraries	C, D	A
Special Libraries	C	
Special Collections and Archives	C	
Archival Organization	C	
Archival Practicum		I
Foundations of Information Science	C	
Library Database Systems	C	
Online Information Retrieval	C	
Government Publications	C	
Research Methods	C	
Library Practicum		I
Research Project	C	

Appendix B: T-tests

```
1. ttest community, by(core)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      25        2.56    .2587148    1.293574    2.026039    3.093961
       1 |       8        2.25    .6196197    1.752549    .7848322    3.715168
---------+--------------------------------------------------------------------
combined |      33    2.484848    .2427791     1.39466    1.990324    2.979373
---------+--------------------------------------------------------------------
    diff |                .31     .572879               -.8583944    1.478394
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.5411
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.7039         Pr(|T| > |t|) = 0.5923          Pr(T > t) = 0.2961


2. ttest community, by(elective)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      18         2.5    .4062421    1.723539    1.642904    3.357096
       1 |      15    2.466667    .2363747    .9154754    1.959693     2.97364
---------+--------------------------------------------------------------------
combined |      33    2.484848    .2427791     1.39466    1.990324    2.979373
---------+--------------------------------------------------------------------
    diff |            .0333333    .4953427               -.9769248    1.043591
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.0673
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.5266         Pr(|T| > |t|) = 0.9468          Pr(T > t) = 0.4734


3. ttest community, by(archive)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      28    2.678571    .2675263    1.415616    2.129653     3.22749
       1 |       5         1.4     .244949    .5477226    .7199126    2.080087
---------+--------------------------------------------------------------------
combined |      33    2.484848    .2427791     1.39466    1.990324    2.979373
---------+--------------------------------------------------------------------
    diff |            1.278571    .6484892               -.0440309    2.601174
------------------------------------------------------------------------------
```

```
    diff = mean(0) - mean(1)                                      t =   1.9716
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9712         Pr(|T| > |t|) = 0.0576          Pr(T > t) = 0.0288


4. ttest community, by(schoollib)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      28    2.214286    .2262949     1.19744    1.749967    2.678604
       1 |       5           4    .7071068    1.581139    2.036757    5.963243
---------+--------------------------------------------------------------------
combined |      33    2.484848    .2427791     1.39466    1.990324    2.979373
---------+--------------------------------------------------------------------
    diff |          -1.785714    .6086117               -3.026986   -.5444426
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.9341
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0031         Pr(|T| > |t|) = 0.0062          Pr(T > t) = 0.9969


5. ttest communityonline, by(core)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      25        2.08    .2075251    1.037625    1.651689    2.508311
       1 |       8       1.875    .3980982    1.125992    .9336474    2.816353
---------+--------------------------------------------------------------------
combined |      33    2.030303    .1819759    1.045372     1.65963    2.400976
---------+--------------------------------------------------------------------
    diff |               .205    .4298528               -.6716905     1.08169
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.4769
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.6816         Pr(|T| > |t|) = 0.6368          Pr(T > t) = 0.3184


6. ttest communityphy, by(core)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      25        1.24    .2785678    1.392839    .6650644    1.814936
       1 |       8       1.125        .125    .3535534     .829422    1.420578
---------+--------------------------------------------------------------------
combined |      33    1.212121    .2121212    1.218544    .7800444    1.644198
```

```
---------+--------------------------------------------------------------------
    diff |                .115    .5024705               -.9097954    1.139795
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   0.2289
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.5898         Pr(|T| > |t|) = 0.8205          Pr(T > t) = 0.4102


7. ttest communityonline, by(elective)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      18           2    .2681332    1.137593    1.434288    2.565712
       1 |      15    2.066667    .2481679    .9611501    1.534399    2.598934
---------+--------------------------------------------------------------------
combined |      33    2.030303    .1819759    1.045372     1.65963    2.400976
---------+--------------------------------------------------------------------
    diff |           -.0666667    .3711199               -.8235707    .6902374
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -0.1796
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.4293         Pr(|T| > |t|) = 0.8586          Pr(T > t) = 0.5707


8. ttest communityphy, by(elective)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      18    2.055556    .2353168    .9983647     1.55908    2.552031
       1 |      15          .2    .1069045    .4140393   -.0292873    .4292873
---------+--------------------------------------------------------------------combined
|      33    1.212121    .2121212    1.218544    .7800444    1.644198
---------+--------------------------------------------------------------------
    diff |            1.855556    .2761674                1.292308    2.418803
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   6.7190
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 1.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 0.0000


9. ttest communityonline, by(archive)

Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
```

```
       0 |      28    2.178571    .1928179    1.020297    1.782942    2.574201
       1 |       5         1.2    .3741657      .83666    .1611494    2.238851
---------+--------------------------------------------------------------------
combined |      33    2.030303    .1819759    1.045372     1.65963    2.400976
---------+--------------------------------------------------------------------
    diff |            .9785714    .4847765               -.0101367     1.96728
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =   2.0186
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.9739         Pr(|T| > |t|) = 0.05          Pr(T > t) = 0.0261
```

10. ttest communityphy, by(archive)

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      28    .8571429    .1760403    .9315175    .4959381    1.218348
       1 |       5         3.2          .2    .4472136    2.644711    3.755289
---------+--------------------------------------------------------------------
combined |      33    1.212121    .2121212    1.218544    .7800444    1.644198
---------+--------------------------------------------------------------------
    diff |           -2.342857    .4292161               -3.218249   -1.467465
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -5.4585
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0000         Pr(|T| > |t|) = 0.0000          Pr(T > t) = 1.0000
```

11. ttest communityonline, by(schoollib)

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      28    1.857143    .1904762    1.007905    1.466318    2.247968
       1 |       5           3    .3162278    .7071068    2.122011    3.877989
---------+--------------------------------------------------------------------
combined |      33    2.030303    .1819759    1.045372     1.65963    2.400976
---------+--------------------------------------------------------------------
    diff |           -1.142857    .4730387               -2.107626   -.1780883
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.4160
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0109         Pr(|T| > |t|) = 0.0218          Pr(T > t) = 0.9891
```

12. ttest communityphy, by(schoollib)

```
Two-sample t test with equal variances
------------------------------------------------------------------------------
   Group |     Obs        Mean    Std. Err.   Std. Dev.   [95% Conf. Interval]
---------+--------------------------------------------------------------------
       0 |      28           1    .2241976    1.186342    .5399846    1.460015
       1 |       5         2.4     .244949    .5477226    1.719913    3.080087
---------+--------------------------------------------------------------------
combined |      33    1.212121    .2121212    1.218544    .7800444    1.644198
---------+--------------------------------------------------------------------
    diff |              -1.4    .5459529               -2.513478   -.2865218
------------------------------------------------------------------------------
    diff = mean(0) - mean(1)                                      t =  -2.5643
Ho: diff = 0                                     degrees of freedom =       31

    Ha: diff < 0                 Ha: diff != 0                 Ha: diff > 0
 Pr(T < t) = 0.0077         Pr(|T| > |t|) = 0.0154          Pr(T > t) = 0.9923
```